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APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
08/310,141	09/20/94	ZANDI A	74451.P024

EXAMINER: JOHNSON, T

ART UNIT	PAPER NUMBER
2616	14

DATE MAILED: 04/15/97

26M2/0415

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This is a communication from the examiner in charge of your application.
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OFFICE ACTION SUMMARY

☑ Responsive to communication(s) filed on 2/27/97

☑ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 D.C. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), ~~or thirty days,~~ ~~whichever is~~ longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☑ Claim(s) 1, 4, 5-8, 11-13, and 15-24 is/are pending in the application.
Of the above, claim(s) 2, 3, 9, 10, and 14 ~~is/are withdrawn from consideration.~~ cancelled
☐ Claim(s) _____ is/are allowed.
☑ Claim(s) 1, 4, 5-8, 11-13, and 15-24 ~~is/are~~ rejected.
☐ Claim(s) _____ is/are objected to.
☐ Claim(s) _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.
☐ The drawing(s) filed on _____ is/are objected to by the Examiner.
☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.
☐ The specification is objected to by the Examiner.
☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.
☐ received in Application No. (Series Code/Serial Number) _____.
☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____.

☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☑ Notice of Reference Cited, PTO-892
☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____
☐ Interview Summary, PTO-413
☐ Notice of Draftperson's Patent Drawing Review, PTO-948
☐ Notice of Informal Patent Application, PTO-152

–SEE OFFICE ACTION ON THE FOLLOWING PAGES–

★ U.S. GPO: 1998-404-496/40517

Part III Detailed Action

Response to Amendment

1. The objections to the specification have been overcome by amendment. The 112/1 rejection of claim 17 has been overcome. The 112/2 rejection of claim 20 has not been overcome by amendment. The 112/2 rejection of claim 18 has been overcome.

2. Applicant's arguments filed February 27, 1997 have been fully considered but they are not persuasive.

That Reusens does not provide for overlapped transforms using longer (non-minimal) filters was not previously claimed for claims 1, 2, 5, 7-9, and 12, but is now claimed by amendment.

The S transform noted on page 7 is not relevant to the claims, since it appears that this transform is implemented using minimal length filters - specification, page 23, lines 9-10 - whereas the claims provide for non-minimal length filters. As for Shapiro providing for minimal length filters and not providing for non-minimal length filters, see the first Office Action, and it is noted in on page 23, lines 10-11 of the specification, that minimal length filters have two taps (it is well known that the number of taps equates to filter length), but that Shapiro provides for 9-tap filters on page 3448, left column, lines 13-16. It is also noted that the claims which provided for non-minimal length filters, claims 3 and 10, have been cancelled.

As for Langdon, Jr. not providing for "a pair of non-minimal length reversible filters", a "pair" was not claimed previously in the original claims or in the claims now as amended, and "non-minimal length filters to perform an overlapped reversible wavelet transform" was not previously claimed for claims 1, 2, 5, 7-9, and 12, but is now claimed by amendment.

Drawings

3. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the "bit significance embedding on the series of coefficients after ordering" as shown in claim 6 must be shown or the feature cancelled from the claim. No new matter should be entered.

Claim Objections

4. Claims 22-23 are objected to because of the following informalities: For newly added claim 22, add "an" before "entropy" on line 8; and for new claim 23, the last two lines are ungrammatical with respect to "receiving all ... coefficients". Appropriate correction is required.

5. Claim 11 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claims, or amend the claims to place the claims in proper dependent form, or rewrite the claims in independent form.

By amendment, claim 10 is now cancelled, from which claim 11 still depends; therefore, claim 11 should be amended accordingly.

Claim Rejections - 35 USC § 112

6. Claim 6 is rejected under 35 U.S.C. 112, first paragraph, because the specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention.

For amended claim 6, it is not clear from the specification that claim 6 provides for "embedding ... after ordering". It appears from the specification on at least page 16, lines 22-25 and page 36, lines 16-19 that "embedding" is part of ordering.

7. Claims 11 and 17-21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 11 recites the limitation "The method defined in claim 10" in line 1. There is insufficient antecedent basis for this limitation in the claim, since claim 10 has been cancelled.

Claim 17 recites the limitation "the series of formatted coefficients" in line 8. There is insufficient antecedent basis for this limitation in the claim, as claim 17 was amended to delete the antecedent basis.

Claim 20 recites high and low order bits. First, the terms "high" and "low" are vague, in that the line of demarcation is unknown. Second, the terms "high order" and "low order" are

incomplete, in that it is unclear what is being referred to as high or low, for example, is it frequency or energy, or even some other parameter? This rejection was maintained from the first Office Action, since "the series of formatted coefficients" in claim 20 lack antecedent basis as noted above for claim 17.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

9. Claims 1, 4-8, and 11-12 are rejected under 35 U.S.C. 103 as being unpatentable over Reusens et al. in view of Shapiro and Woods.

For claim 1, the arguments to claim 1 in the first Office Action are incorporated herein, as well as cancelled claims 2 and 3, parts of which were incorporated into amended claim 1. Applying an overlapped reversible wavelet transform using non-minimal length reversible filters to produce a series of coefficients is provided by Reusens et al. and Shapiro. A reversible wavelet transform using filters to produce a series of coefficients is provided by Reusens et al. in section 2.1 on page 382, where wavelet filters are explicitly noted and synthesis filters provide for a reversible wavelet transform, since synthesis refers to the inverse dual operation of analysis, where the signals are reconstructed. Reusens et al. also provide for decoding, which is where synthesis is done, as noted in the first Office Action regarding claims 7 and 8, on page 384 in the last sentence of the first paragraph of section 4, by providing for a "codec", i.e. a coder-decoder, where this is also noted as the title of section 2 on page 381.

Overlap may be considered as provided in several ways to include 1. the wavelet transform of Reusens et al. in section 2.1 on page 382, where the high frequency channel is obtained from the low frequency filter; 2. as noted in the first Office Action regarding previous

claim 3; 3. in light of the specification where overlap means that the length is greater than the number of filters, where this is provided by Shapiro, where Woods is used only to show that Shapiro does satisfy this definition as follows: Shapiro provides for 9-tap quadrature mirror filters on page 3448, left column, lines 13-16, where the number of taps corresponds to the length of the filters, where Woods notes that QMFs may consist of one pair of filters in the first paragraph on page 102, and examples of two filters is shown in Fig. 3.2 and 3.3 on pages 105 and 106. Woods also provides for 80-tap filters in a 16-band system (indicating 16 filters), which are noted on page 180 in the first paragraph of section 4.6, and lapped orthogonal transforms (e.g. wavelet transforms) are provided in the bottom paragraph of page 103, thus it would have been obvious to one having ordinary skill in the art at the time the invention was made to use these overlapped transforms as well, since they are used in a subband system of which is used by both Reusens et al. and Shapiro.

Shapiro provides for non-minimal length filters, since minimal length filters consist of two taps, but the filters of Shapiro consist of 9 taps, and other filter lengths may also be used such as the 32- or 80-tap filters noted on page 180 or the 13-tap filters on pages 186 and 189 of Woods, where it would have been obvious to one having ordinary skill in the art at the time the invention was made to use these filter lengths, since these filters are QMFs, which are used by Shapiro. The non-minimal length filters of Shapiro can be used by Reusens et al. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the non-minimal filters of Shapiro, since they are also used in a wavelet/subband system where these filters have good localization properties, allow for simple edge treatments, and produce good empirical results as noted by Shapiro on page 3448 in the first two paragraphs in the left column.

This claim may be construed in two different ways as indicated in the first Office Action with respect to cancelled claim 3, where both Reusens et al. and Shapiro provide for a "losslessly compressed version" of the input. Compressing the coefficients into a losslessly compressed version of the input data is provided by Shapiro as shown in Fig. 3 on page 3448 and for coefficients in the title of section III on page 3448, and Reusens et al. provide for the above in at least the abstract and in Fig. 1 on page 381. The reference of Reusens et al. is not necessary for a strict interpretation of "a losslessly compressed version", since Shapiro provides for lossless

compression in Fig. 3 noted above, although lossy compression is also provided, so that Shapiro and Woods may also satisfy this claim, where Woods is primarily used for clarification. Shapiro also provides for a reversible wavelet transform as noted in the first Office Action with respect to claims 3, 4, 6, 10, and 11.

For claim 4, as noted in the first Office Action, Shapiro provides for a plurality of one-dimensional filters, and Woods also provides for a plurality of one-dimensional filters on at least pages 103-104.

For claim 5, an image is provided for in the title of Reusens et al.

For claim 6, see the 112/1 rejection and the objection to the drawings above regarding claim 6. The rejection to the original claim 6 is incorporated herein. A series of coefficients is provided for as noted above for claim 1. As best understood, performing bit significance embedding on the coefficients after ordering is provided by Shapiro on page 3446 in the left column, where ordering by importance of the coefficients is provided under the fourth bulleted paragraph under section B and in section C, where it is indicated that the "embedding" is performed in order, and therefore after ordering.

For claims 7, decompressing the losslessly compressed version, and generating the reconstructed version of the original using an inverse wavelet transform is provided in the last sentence of the first paragraph of section 4 on page 384 of Reusens, where wavelet coding using a codec (coder-decoder) inherently provides for a reverse wavelet transform in order to losslessly reconstruct the original image which is shown in Fig. 4 on page 385.

For claim 8, see the rejections to claims 1 and 7 above, and the rejection to claim 10 (now cancelled) from the first Office Action, where Shapiro provides for the inverse operation of decoding by synthesis to reconstruct the original data. The original rejection to claim 8 is incorporated herein.

For claim 11, see claim 4 above, as well as the 112/2 rejection above.

For claim 12, the original rejection to claim 12 is incorporated herein. For claim 12 as amended, as noted above for claim 1, Woods shows in Figs. 3.2 and 3.3, that a first and second pair of filters is used in conventional subband coding such as QMF coding and explicitly notes "reconstruction" on page 105 and filter pairs in the bottom of page 106. Shapiro can use the

filters of Woods, as they are part of a QMF system, and Shapiro may already use these filters, since as noted above for claim 1, Woods and Shapiro both provide for 9-tap filters in a QMF system. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the filters of Woods with Shapiro, since these filters are conventionally used in QMF subband systems of which are provided by both Woods and Shapiro.

10. Claims 13 and 15-21 are rejected under 35 U.S.C. 103 as being unpatentable over Reusens et al. in view of Shapiro and Woods, as applied to claims 1, 4-8, and 11-12 above, and further in view of Hartung et al.

The original rejection to claim 13 is incorporated herein by copying from the first Office Action herein below:

For claim 13, Shapiro discloses an embedded wavelet transform encoding system on page 3446, in the first four lines of section B. Shapiro also provides for ordering the coefficients and bit significance embedding of the coefficients in the third and fourth bulleted paragraphs of section B on page 3446. Shapiro does not provide for the concept of two different codings of first and second portions of the data. Hartung discloses a subband image compression system as noted in the title and as shown in Fig. 1. Hartung also provides for ordering the coefficients and bit significance embedding in col. 1, line 45 - col. 2, line 14, in that the significance of the subbands is ascertained so that ordering of the bands are coded differently, where the lowest frequency band with the most energy is PCM coded, and the upper frequency bands are encoded with a different scheme, where the coefficients are ordered by a bit allocation scheme. Shapiro can use an adaptive encoding scheme where he may use different coders based on energy or other parameters. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the adaptive encoding scheme of Hartung, since it is common to accurately encode the subband with the most energy (information).

Additionally for claim 13 as amended, see claims 1 and 12 above, and the original rejection to claim 13 from the first Office Action, which is incorporated herein above.

For claim 15, Shapiro provides for tree coding in the second bulleted paragraph under section B. on page 3446. Hartung does not provide for tree coding for a first type of coding, but

rather uses PCM. Using the concept of Hartung, Shapiro can use his tree coding in place of the Hartung's coding. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use tree coding for a first type of coding, since it is well known that zerotree coding allows the successful prediction of insignificant coefficients as taught by Shapiro in the second bulleted paragraph of section B on page 3446.

For claim 16, Shapiro provides for formatting the coefficients into sign-magnitude format on lines 12-18 of the second column on page 3453.

For claim 17, Shapiro provides for reversible wavelet transforming of the input as noted above for claim 13, and where the wavelet transform is reversible, since the decoding process is able to decode as noted in the first sentence in section VI on page 3457. The coefficients are converted into sign-magnitude format as noted for claim 16 above. Two different types of coding are used for a first and second bit stream as noted above for claim 13, and the bit streams are combined into a single bit stream as shown in block 430 of Fig. 2 of Hartung.

Additionally for claim 17 as amended, see also claim 13 above.

For claim 18 as amended, Shapiro provides for entropy coding a bit stream in the last block of Fig. 3 and in the third paragraph in the left column on page 3448.

For claim 19, see claim 15 above.

For claim 20, as amended and as best understood, see the 112/2 rejection above, coding different portions is already provided for as noted above for claim 17 by Hartung et al. Portions comprising high order and low order bits is provided by Shapiro where coding is based on magnitude, importance, and significance, where bit importance is noted in the bottom of the right column on page 3446, where bits by importance will have a relative high and low order. The original rejection to claim 20 is incorporated herein.

For claim 21, Shapiro provides for a losslessly compressed version of the input, since he uses an arithmetic coder on page 3454 in the title of paragraph C which is well known to be a lossless encoder.

11. Claims 22-24 are rejected under 35 U.S.C. 103 as being unpatentable over Shapiro in view of Woods.

For claim 22, see the rejections for claims 1, 12, and 13 above, where Shapiro provides for a reversible wavelet filter and Woods explicitly provides for a pair, where it is obvious as noted above. Shapiro further provides for an embedded coder for performing embedding coding on the wavelet coefficients, because embedding is provided by generating the bits in order of importance as noted in the first few lines of the abstract of Shapiro and where embedded coding is provided on the wavelet coefficients in the first three bulleted paragraphs in section B on page 3446, so that embedded coding is provided after wavelet transforming and is also indicated in the paragraph under section III on page 3448, and see Fig. 3 on the same page, where transformation is provided first, and where entropy coding is provided last as claimed, and entropy coding is also provided in the fifth bulleted paragraph under section B on page 3446 of Shapiro.

For claim 23, see claim 22 above. As for producing coded data prior to receiving all coefficients, this is provided by Shapiro in the last bulleted paragraph under section B on page 3446 and in the last paragraph of section A on pages 3453 and 3454, because the coder runs sequentially and can be stopped and thus not receiving all coefficients.

For claim 24, encoding the significance map of the wavelet coefficients on page 3448 in section III of the left column provides for coding the data on a single pass, where the significance map is part of the embedded coder, because it is used to provide an embedded code by ordering in importance as noted in the first few lines in the second column on page 3445. It is also noted that the "successive-approximation" which provides for two passes is evidently not necessary as noted in the first few lines in the left column on page 3453. Furthermore, although Shapiro provides for two passes in the successive-approximation coding, it is noted that on the first "dominant pass", that coding is provided, so that data is again coded in a single pass with the embedded coder.

Final

12. Applicant's amendment necessitated new grounds of rejection. Accordingly, THIS ACTION IS MADE FINAL. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for response to this final action is set to expire THREE MONTHS from the date of this action. in the event a first response is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. in no event will the statutory period for response expire later than SIX MONTHS from the date of this final action.

Contact Information

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Timothy M. Johnson whose telephone number is (703) 306-3096.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 305-3900.

The Group Art Unit FAX number is (703) 308-5397.

TJ
Timothy M. Johnson
Patent Examiner
Group Art Unit 2616
April 13, 1997